



# SELF-BALANCING MOTORCYCLE

**Items required: Motorcycle model assembled, laptop with Matlab & Simulink installed, USB connector, internet connection (for the learning platform).**

*Load the demo of the motorcycle in self-balancing mode: motoSys2\_balance.slx.  
Load the project and explain the features with the project running.*

## 1. EXPLAIN WHAT THE CHAPTER IS ABOUT

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*While explaining the chapter, show the outcome of the exercise (the final project already built).*


In this chapter, students learn about control systems design and how to apply it to Arduino using Simulink in order to balance a motorcycle. They will go through the different components of the motorcycle and program them in order to make it stand using PD control with a spinning inertia wheel system.

## 2. EXPLAIN WHAT IS INCLUDED IN THE CHAPTER

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*Show in detail demo examples of each section and explain each one.*

**Physics and Theory of PD control:** The beginning of the chapter explains the physical dynamics of the motorcycle-inertia wheel system and goes through the equations of motion for the system. It identifies the control terms in a PD controller



and helps students understand their respective effects in a closed-loop control system.

**Program components:** It moves on to demonstrate how to create Simulink models to configure and test individual sensors and create a control algorithm to balance the system. The control algorithm is also affected by readings from different components such as the battery or the speed of the inertia wheel.

**Safety mechanisms and monitoring:** It also explains how to implement safety features to ensure that the motorcycle operates with minimal stress to hardware components and how to monitor the motorcycle's physical response to the control algorithm.

